AMENDMENTS TO THE DRAWINGS

The attached sheet of drawings include changes to FIG. 10. This sheet replaces the original sheet. The bottom six entries in the fourth column have been changed from "5" to "0.5" per the Examiner's suggestion.

REMARKS

In response to the Office Action dated January 5, 2007, claim 1 is amended, and claims 12-16 are new. Claims 1, 3, 4, and 12-16 are now active in this application. No new matter has been added. The amendments are supported, at a minimum, by FIG. 10 which states 0.28 W/cm^2 for Example 7, and 0.45 W/cm^2 for Example 8. New claim 16 is supported, at a minimum, by FIG. 6. Specifically, the second circle from the left in FIG. 6 represents to a nitrogen concentration of approximately 2.5% (reading from the horizontal scale), and the eighth circle from the left represents a nitrogen concentration of approximately 40%.

The specification was objected to because of informalities. Applicants have amended page 25, lines 6-7 according to the Examiner's suggestions as follows, "when N_2 gas is added to a mixed gas containing O_2 gas and [[N_2]] $\underline{CF_4}$ gas." Thus, Applicants respectfully submit that this objection should be withdrawn.

The drawings were objected to because the Examiner asserted that the last 6 entries in column 4 contained a typographical error, and should read "0.5", and not "5". Corrected drawing sheets have been submitted according to the Examiner's suggestions. Thus, Applicants respectfully submit that this objection should be withdrawn. Note that if CF_4 is the only source of C and F, then the etching conditions must have an atomic % of C (fourth column) which is 1/4 as great as the atomic % of F (fifth column). Thus, column 4 should be 0.5, and column 5 should be 2 for Example 7 through Example 8.

Claims 1, 3, and 4 were rejected under 35 U.S.C. §112, first paragraph, as failing to enable one of ordinary skill in the art. These rejections are traversed.

The Office Action, at page 3, asserts that it is "the A/B ratio is dependent upon the particular wavelengths that are selected as being representative of A and B" and that "there is no disclosure regarding what specific wavelengths are used to determine the A/B ratio."

However, Applicant's specification, at page 23, lines 15-25, states:

> FIG. 5 is a graph showing intensity ratios A/B obtained from a plurality of etching gases among which the concentration ratios of CF_4 gas varied while utilizing a mixed gas composed of CF_4 gas and O_2 gas as each of the etching gases. Each of peaks at wavelengths of 614 nm, 777 nm, and 844 nm was used as the emission peak X, whereas the peak at a wavelength of 558 nm was used as the emission peak Y, whereby the intensity ratio A/B was calculated. Though slight fluctuations were seen in the three measurement results among which the wavelength of emission peak X varied, similar tendencies were obtained.

Claim 1 states, in part, "wherein said mixed gas contains nitrogen gas in an amount such that **the intensity ratio A/B of said mixture is greater than the intensity ratio A/B of pure oxygen**, where A is the intensity of an emission peak caused by atomic oxygen and B is the intensity of an emission peak caused by molecular oxygen." Emphasis added.

Note that the term "atomic oxygen" in claim 1 refers to oxygen atoms that are in a disassociated or in a plasma state. These oxygen atoms are not in the typical paired or associated condition of "molecular oxygen" or O_2. Thus, these oxygen atoms are very reactive.

Thus, it does not matter which wavelengths of A and B are selected with respect to claim 1. The intensity ratio of the wavelengths increases as the concentration of the component associated with A (atomic oxygen) increases relative to the concentration associated with B (molecular oxygen).

As a matter of convenience, it is preferable (although not required) to use wavelengths with large peaks, such as 777 nm for atomic oxygen and 558 nm for molecular oxygen. See FIG. 4 of the application. Also see page 22, line 16 through page 23, line 11 for additional discussion.

Thus, Applicants respectfully submit that claims 1, 3, and 4 are enabled.

Claims 1, 3, and 4 were rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. These rejections are traversed.

The Office Action, at pages 3 and 4, states that "[t]he only disclosure pertaining to the effect of N_2 on the O: O_2 ratio is when the other component of the plasma gas is a 99:1 mixture of O_2 and CF_4" and "[a]side from the one example containing 1% CF_4, there is no evidence, nor suggestion in the disclosure that there is any particular amount of N_2 that would be responsible for bringing about the claimed inversion of the A/B ratio."

First, the Applicants do not assert that the A/B ratio is inverted. Rather, Applicants have discovered, at specification page 23, lines 7-11, that "[w]hen the mixed gas containing CF_4 gas and O_2 gas further contains nitrogen gas, **the intensity ratio A/B is improved**, so that the diamond etching speed is enhanced." Emphasis added.

Claim 1 recites, in part, "wherein said mixed gas contains nitrogen gas in an amount such that the intensity ratio A/B of said mixture is greater than the intensity ratio A/B of pure oxygen, where A is the intensity of an emission peak caused by atomic oxygen and B is the intensity of an emission peak caused by molecular oxygen." Therefore, claim 1 simply claims all concentrations of nitrogen that increase the intensity ratio A/B of the mixed gas in reference to the intensity ratio A/B of pure oxygen.

Thus, Applicants respectfully submit that claims 1, 3, and 4 comply with the written description requirement.

Claims 1, 3, and 4 were rejected under 35 U.S.C. § 103 as being unpatentable over Shiomi, "High-Rate Reactive Ion Etching of Diamond and Fabrication of Pourous Diamond for Field-Emission Cathode" (hereinafter Shiomi), in view of U.S. Patent 6,261,726 to Brooks et al.

(hereinafter Brooks), and further in view of U.S. Patent 6,013,191 to Nasser-Faili et al. (hereinafter Nasser-Faili).

Amended independent claim 1 recites, in part, "a plasma of a mixed gas composed of a gas containing an **oxygen** atom and a gas containing a **fluorine** atom. . . high-frequency discharge is generated by supplying an electric **power of less than 1.0 W/cm^2** between said plate electrodes, and said mixed gas further contains **nitrogen** gas." Emphasis added.

In order to establish *prima facie* obviousness under 35 U.S.C. § 103(a), all the claim limitations must be taught or suggested by the prior art. *In re Rokya*, 490 F. 2d 981, 180 USPQ 580 (CCPA 1974). At a minimum, the cited prior art does not disclose (expressly or inherently) the above recited limitation.

Shiomi merely discloses reactive ion etching of diamond using O_2 and CF_4 plasma at page 7745, and an RF (radiofrequency) power of "100-400 W" at Table 1.

Brooks, at column 6, lines 59 to 64, merely discloses "[e]tching high aspect ratio features with good pattern fidelity is possible using organic agents. Good results have been achieved using low pressure reactive ion etching containing oxygen, e.g., an O_2 / N_2 plasma etch. . . Optionally, additives such as CO, CO_2 or hydrocarbons may be employed."

Nasser-Faili, at abstract, merely discloses "polishing the surface of a diamond film with a low power density plasma in a reactor which comprises disposing O_2 gas and a fluorinated gas such as SF_6, NF_3, and C_2F_6 in the reactor, providing power to the reactor so that the power density in the reactor is between about 1.0 watts/cm^2 and about 1.1 watts/cm^2 for a first duration."

Even assuming, for the sake of argument, that it is proper to combine all of these references, none of cited art discloses etching diamond at a **power of less than 1.0 W/cm^2** using a mixed gas comprising the elements oxygen, fluorine, and nitrogen.

Note that Nasser-Faili describes watts/cm^2 as "low power," and thus effectively teaches away from using extremely low power in the range of "less than 1.0 W/cm^2" recited by claim 1.

Applicants have discovered that the addition of nitrogen to a plasma gas containing oxygen and fluorine has the **unexpected result of allowing a reduction in plasma power.** This unexpected result appears to be due to an increase in the ratio of disassociated oxygen atoms to whole oxygen molecules (O_2). Specifically, Applicants have stated, at page 23, lines 7-11, that "[w]hen the mixed gas containing CF_4 gas and O_2 gas further contains nitrogen gas, **the intensity ratio A/B is improved**, so that the diamond etching speed is enhanced." Emphasis added. This improved intensity ratio A/B indicates more disassociated oxygen atoms at a given power level. Thus, the power may be reduced to extremely low levels, or the etching speed may be increased at constant levels.

Thus, Applicants respectfully submit that claim 1 is distinguished over the cited art for at least the above reasons.

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as independent claim 1 is patentable for the reasons set forth above, it is respectfully submitted that all claims dependent thereon (claims 3, 4, and 16) are also patentable.

Thus, Applicants respectfully submit that dependent claims 3, 4, and 16 are distinguished over the cited art for at least the same reasons as independent claim 1.

New independent claim 12 recites, in part, "etching said diamond substrate using a plasma of a mixed gas, wherein the plasma of the mixed gas comprises oxygen atoms, fluorine atoms, and nitrogen atoms; and generating a high-frequency discharge between two plate electrodes by supplying an electric power of less than 1.0 W/ cm^2 between said plate electrodes."

Applicants respectfully submit that independent claim 12 is distinguished over the cited art for the same reasons as independent claim 1.

Additionally, Applicants respectfully submit that claims 13 and 14 depend from independent claim 12, and are distinguished over the cited art for at least the same reasons as independent claim 12.

New independent claim 15 recites a diamond product with a projection or depression "having at least one side face with an angle of inclination of at least 78 degrees."

Applicants respectfully submit that none of the cited prior art teach or suggest an angle of inclination of at least 78 degrees in a projection or depression of a diamond product.

Accordingly, it is urged that the application, as now amended, is in condition for allowance, an indication of which is respectfully solicited. If there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, Examiner is requested to call Applicants' attorney at the telephone number shown below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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